



## Original Article

## Prevalence and Risk Factors of Intestinal Parasitosis in Urban and Peri-Urban Areas of Yaoundé, Cameroon: A Prospective Cross-Sectional Study in 4 Hospitals

*Prévalence et Facteurs de Risque des Parasitoses Intestinales en Zones Urbaine Et Péri-Urbaine à Yaoundé, Cameroun : Une Étude Transversale Prospective dans 4 Hôpitaux*

Solange Meyin A Ebong<sup>1</sup>, Arlette Corine Modjo Fondjo<sup>2</sup>, Sarah Pauline Ngo Miyem<sup>1</sup>, Vigny Ndé Kengne<sup>1</sup>, Ghislaine Metsina Ndzana<sup>1</sup>, William Abange Baiye<sup>3,4</sup>

### Affiliations

1. Department of Microbiology, Faculty of Science, University of Yaoundé I, P.O. Box 812, Yaoundé, Cameroon.
2. Faculty of Health Sciences of Protestant University of Central Africa, B.O. Box 4011, Yaoundé, Cameroon.
3. Department of Medical Laboratory Sciences, Faculty of Health Sciences University of Buea, Cameroon.
4. Parasitology Laboratory and Mycology Laboratory, Yaounde University Teaching Hospital, Cameroon.

### Corresponding author

Solange Meyin A Ebong  
Email : ebongsolange@yahoo.fr  
Tel: (237) 677926583

**Key Words:** Intestinal parasitosis, urban area, peri-urban area, Yaoundé

**Mots clés :** Parasitoses intestinales, zone urbaine, zone périurbaine, Yaoundé

### Article history

Submitted: 21 March 2026  
Revisions requested: 4 May 2026  
Accepted: 23 May 2026  
Published: 26 May 2026

### ABSTRACT

**Introduction.** The digestive tract can host many parasitic species with variable pathogenicity, from asymptomatic carriage to severe disease. In Cameroon, data comparing urban and peri-urban areas are limited. This study determined the prevalence of intestinal parasitosis in urban and peri-urban Yaoundé and identified the parasite species and associated risk factors. **Methods.** A prospective cross-sectional study was conducted from December 2023 to March 2024 in four Yaoundé hospitals (two urban, two peri-urban). We included 302 consenting patients who had not taken antiparasitic drugs for at least one week. Stool samples were analysed by direct examination and concentration techniques (Kato-Katz, Ritchie). Logistic regression identified associated factors. **Results.** Overall prevalence of intestinal parasitosis was 41.4% (125/302). Protozoa accounted for 98.3% of identified parasites (170/173), dominated by *Entamoeba histolytica* (39.3%), *Blastocystis hominis* (24.3%) and *Entamoeba coli* (24.3%). Helminths (*Ascaris lumbricoides*, *Strongyloides stercoralis*) were rare (1.7%). Peri-urban areas had higher prevalence (48.7% vs 40.3% in urban). Independent risk factors were female sex (OR=1.74), age 21-30 years (OR=5.22), tap water consumption (OR=2.66) or well water (OR=3.24), average hygiene (OR=3.47) and poor hygiene (OR=6.50). **Conclusion.** Intestinal parasitosis is very common in Yaoundé, with a strong predominance of protozoa. Access to safe water and improved hygiene are essential prevention measures.

### RÉSUMÉ

**Introduction.** Le tube digestif peut être colonisé par de nombreuses espèces parasitaires, dont la pathogénicité varie du simple portage asymptomatique à des formes sévères. Au Cameroun, les données comparatives entre zones urbaine et péri-urbaine sont limitées. Cette étude a déterminé la prévalence des parasitoses intestinales dans les zones urbaine et péri-urbaine de Yaoundé et identifié les espèces en cause ainsi que les facteurs de risque associés. **Méthodes.** Étude transversale prospective menée de décembre 2023 à mars 2024 dans quatre hôpitaux de Yaoundé (deux urbains, deux péri-urbains). Nous avons inclus 302 patients ayant donné leur consentement, sans traitement antiparasitaire depuis au moins une semaine. Les selles ont été analysées par examen direct et techniques de concentration (Kato-Katz, Ritchie). Une régression logistique a identifié les facteurs associés. **Résultats.** La prévalence globale de la parasitose intestinale était de 41,4 % (125/302). Les protozoaires représentaient 98,3 % des parasites identifiés (n = 170/173), dominés par *Entamoeba histolytica* (39,3 %), *Blastocystis hominis* (24,3 %) et *Entamoeba coli* (24,3 %). Les helminthes (*Ascaris lumbricoides*, *Strongyloides stercoralis*) étaient rares (1,7 %). La zone péri-urbaine présentait une prévalence plus élevée (48,7 % contre 40,3 % en zone urbaine). En analyse multivariée (régression logistique), les facteurs de risque indépendants étaient : le sexe féminin (OR = 1,74), l'âge 21-30 ans (OR = 5,22), la consommation d'eau du robinet (OR = 2,66) ou d'eau de puits (OR = 3,24), une hygiène moyenne (OR = 3,47) ou mauvaise (OR = 6,50). **Conclusion.** Les parasitoses intestinales sont très fréquentes à Yaoundé, avec une forte prédominance des protozoaires. L'accès à une eau de qualité et l'amélioration des conditions d'hygiène sont des leviers essentiels de prévention.

**HIGHLIGHTS FOR READERS IN A HURRY**

**What is already known on this topic.** Intestinal parasitosis is common in sub-Saharan Africa, linked to poor sanitation, lack of clean water and poverty. Prevalence varies by region and population.

**The question this study addressed.** This cross-sectional study compared the prevalence of intestinal parasitosis and identified parasite species in 302 patients attending four hospitals in urban and peri-urban Yaoundé.

**What this study adds to our knowledge.** Overall prevalence is 41.4%, higher in peri-urban areas (48.7%). Protozoa predominate (98.3%), with *Entamoeba histolytica* (39.3%), *Blastocystis hominis* (24.3%) and *Entamoeba coli* (24.3%) most common. Helminths are rare (1.7%). Risk factors are female sex (OR=1.7), age 21-30 years (OR=5.2), tap water (OR=2.7) or well water (OR=3.2), average hygiene (OR=3.5) and poor hygiene (OR=6.5).

**How this is relevant to clinical practice, policy or further research.** These findings call for improving access to safe drinking water, promoting good hygiene practices, and implementing targeted deworming programmes. Further studies are needed to assess the impact of such interventions on parasite transmission.

**INTRODUCTION**

Parasites are organisms that live at the expense of their hosts, causing damage that can lead to diseases affecting various organs. The digestive tract, for example, can be colonized by several species of parasites responsible for digestive or intestinal parasitosis. The pathogenicity of parasites is highly variable, ranging from simple asymptomatic carriage to severe, even fatal, symptomatic clinical presentations [1]. These infections are mainly caused by Protozoa and Helminths, which are the most widespread groups responsible for waterborne diseases worldwide, with an enormous associated morbidity burden [2]. Widespread, intestinal parasitic infections represent a serious public health problem. According to a global review of parasitic disease epidemiology, more than 3 billion people were infected worldwide in 2007 [3]. WHO estimates that more than 2 million people, especially children under five living in developing countries, die each year from parasitic diseases resulting from inadequate hygiene and sanitation [4]. A previous study found an overall prevalence of 34.2% in Iran [5]. In Africa, factors such as overcrowding, lack of safe drinking water, poor food hygiene, and inadequate sanitation facilities are strongly implicated in increasing the overall prevalence of intestinal parasitic infections to 63.3% [6]. In Ethiopia, prevalence of 46.3% was observed among food handlers working in catering establishments [7]. In Morocco, previous study showed a prevalence of 23.8% among children with intestinal parasitic infections at the Military Hospital [8]. In the Tunis region, a study reported an overall prevalence of 41% [9]. In Cameroon, intestinal parasitic infections prevalence of 38.3% was reported by a study conducted in Douala [10]. A study on intestinal parasitic infections in children aged from zero to five years in Yaoundé showed a prevalence of 53.3%, compared to a prevalence of 30% reported by

an epidemiological survey conducted in the Maga city in Far North region of Cameroon [11, 12].

Intestinal parasitosis, often referred as diseases of filth, are prevalent in areas where certain risk factors (unsanitary conditions, lack of drinking water, lack of latrines, etc.) are present. A multivariate analysis of risk factors and the occurrence of intestinal parasitosis in a study conducted in Iran showed a correlation between the source of drinking water, place of residence (rural/urban), and parasitosis [5]. Consumption of commercially available or well water, as well as hygiene practices such as handwashing before meals, after using the toilet, and before cooking, nail trimming, and wearing appropriate work clothes and shoes, were statistically associated with intestinal parasitic infection [7].

The present study aimed to determine the prevalence of intestinal parasitosis in some hospitals in urban and peri-urban areas of Yaoundé and to identify the different parasites species involved.

**METHODOLOGY****Study Design**

A prospective, cross-sectional study was conducted in four hospitals in the urban and peri-urban areas of Yaoundé over a four-month period (December 2023 to March 2024). Participants were recruited from the selected hospitals, two of which were in urban areas: the University Teaching Hospital Yaounde (UTHY) and the Biyem-Assi District Hospital, and two in peri-urban areas: the Soa District Hospital and the Mbankomo District Hospital. These hospitals were chosen based on their ease of access and patient capacity. Collected samples were analyzed in laboratories of these hospitals and in the Parasitology Laboratory of the UTHY, which has adequate technical facilities. Study population consisted of patients who came for consultations at these hospitals during the study period, had a stool examination report, had given their consent to participate in the study, and had not taken antiparasitic medication for at least one week prior to enrollment.

**Sample Size**

A survey was conducted using the quota sampling method, which corresponds to the number of individuals meeting the pre-established inclusion criteria. The sample size was calculated using the prevalence of 38.3% of parasitic diseases found in a study conducted in Douala, Cameroon [10]. The Lorentz formula yielded a sample size of 351 participants to be interviewed, with a margin error of 5%.

$$N = \frac{t^2 \times p(1-p)}{m^2}$$

$$N = \frac{1,96^2 \times 0,383 \times (1-0,383)}{0,05^2} = 351,16$$

with

N = sample size

t: 95% confidence level = 1.96

m: margin of error (5% = 0.05)

p = prevalence or proportion of the variable studied in the population

### Participant Recruitment and Sample Collection

Each participant was enrolled after signing an informed consent form during a confidential interview. This interview explained the importance of our study and gathered sociodemographic and clinical information using a pre-established questionnaire. For minor participants, parental consent was signed by a parent or guardian. Sterile, clearly labeled stool container was provided to each participant after a brief explanation of the collection procedure. Participants were instructed to collect a 3-4g of stool sample themselves, adhering to strict aseptic conditions. The collected samples were placed in coolers and transported directly to the laboratory for analysis.

### Parasitological Analysis of Samples

Parasitological analysis of stool samples is primarily based on microscopic observation of mounted samples between slides and coverslips. Analysis is performed either directly after collection or after concentrating a large volume of stool into a smaller volume, thus increasing the likelihood of observing parasitic elements. Thus, fresh samples were immediately prepared on a portion of sample at the laboratory of each recruitment hospital to identify vegetative forms, protozoan cysts, and helminth eggs. Macroscopic examination was performed to note the presence or absence of helminth larvae or adults, their abundance, consistency, texture, odor, color, and the presence of blood, mucus, or pus in the stool samples. Remaining samples were placed in coolers and transported to the Parasitology Laboratory at UTHY under strict aseptic conditions for further analysis using concentration techniques.

The fresh preparation method involved mounting a small amount of stool between a slide and coverslip in either a drop of physiological saline or a drop of Lugol's iodine (which enhances the contrast of protozoan cysts and helminth eggs) and observing it under a 40x optical microscope [13]. This technique, performed immediately after collection, allows identification of vegetative forms (less resistant to external conditions) due to their motility. To increase chances of observing parasitic elements, the following concentration techniques were used: 1) the Kato Katz method, a technique for clearing parasitic elements in a thick smear using Kato's solution, allowed for observation and quantification of helminth eggs as

previously described [13]; 2) The Ritchie (formalin-ether/ethyl acetate sedimentation) concentration, a qualitative technique consisting of dissolving a quantity of stool in a mixture of formalin and ether and collecting a pellet containing the parasitic elements (protozoan cysts and helminth eggs) at the bottom of the tube. The pellet obtained was reconstituted, and a drop was mounted between a slide and coverslip and then observed under a light microscope with a 10x and later 40x objective [13]. Modified Ziehl-Neelson staining, performed only in immunocompromised patients, was carried out to look for specific parasitic forms, particularly the oocysts of parasites of the genus *Cryptosporidium*, which are bright red or pink in varying shades and contain four black sporozoites arranged around a rounded residual body. For *Isospora belli*, the oocysts are oval-shaped, containing one sporoblast and sometimes two more or less differentiated sporocysts. For *Cyclospora cayentanensis*, two sporocysts can be distinguished, but the sporozoites are rarely visible under a light microscope [13].

### Statistical Analysis

The data collected in this study were recorded and processed using Microsoft Excel 2013 software, and the statistical analysis was performed using CSPRO 8.0.1 software.

## RESULTS

### Socio-demographic and clinical characteristics of participants

In this study, 380 patients were contacted, but a total of 302 were enrolled and provided 302 stool samples, which were analyzed for parasites. Most of the participants, 228 (75.49%), were recruited from the Biyem-Assi District Hospital; 122 (40.39%) were male and 180 (59.60%) were female; age of the participants ranged from 3 to 60 years, with the most represented age group being 6-15 years (30.46%), followed by those under 6 years (29.13%); the least represented was those over 45 years (1.65%). School children were the most represented group (26.49%), followed by university students (19.86%). Majority of participants ate food prepared at home (87.06%); mineral water was the most consumed by the majority of participants (45.36%); (30.79%) of participants complained of abdominal pain, (28.14%) had a fever (Table 1).

**Table 1 : Socio-demographic and clinical characteristic of participants**

Variables		N	%
Origin of the participants	BiyemAssi Hospital	228	75,49
	YUHC	35	11,58
	Mbankomo Hospital	19	6,29
	Soa Hospital	20	6,62
Sex	Female	180	59,6
	Male	122	40,39
Age	< 6	88	29,13
	6 – 15	92	30,46
	16 – 25	45	14,9
	26 – 35	39	12,91
	36 – 45	33	10,92
	> 45	5	1,65
Occupation	farmers	56	18,54

	breeders	40	13,24
	schoolchildren	80	26,49
	students	60	19,86
	civil servants	15	4,96
	Housewives	51	16,88
Water source	mineral water	137	45,36
	tap water	54	17,88
	well water	102	33,77
	water in sachets	7	2,31
Food source	House	263	87,06
	outside the house	38	12,58
Symptoms	Abdominal pain	93	30,79
	fever	85	28,14
	Vomiting	28	9,27
	Diarrhea	24	7,94
	Rash	15	4,96
	Fatigue	13	4,3
	stomach upset	6	1,98
	bloating	6	1,98
	loss of appetite	6	1,98
	nausea	5	1,65
	Weakness	4	1,32
	Body aches	3	0,99
	Constipation	4	1,32
	Lower abdominal pain	4	1,32
	Paleness	3	0,99
	Bloody stools	3	0,99

### Positivity of Intestinal Parasitosis

A total of 302 stool samples were analyzed in this study, of which 125 (41.40%) were positive for parasitic elements and 177 (58.60%) were negative (Figure 1A). A positivity rate of 84.80% was reported in urban areas compared to 15.20% in peri-urban areas (Figure 1B).

One hundred and seventy-three parasitic elements belonging to 11 species were identified, of which 170 (98.3%) were protozoa and 3 (1.7%) were helminths. Among protozoa, *Entamoeba histolytica* was the most represented species at 39.3% (68/173), followed by *Blastocystis hominis* and *Entamoeba coli* at 24.3% (42/173); *Trichomonas intestinalis* was the least represented protozoan at 0.6% (1/170). Of the three helminths identified, two were *Ascaris lumbricoides* and one was *Strongyloides stercoralis* (Table 2).

The Mbankomo District Hospital recorded the highest number of identified intestinal parasites (64 parasites, 37.0%), followed by the Soa District Hospital (43 parasites, 24.9%), the University Teaching Hospital Yaounde (37 parasites, 21.4%), and the Biyem Assi District Hospital (28 parasites, 16.2%). *E. histolytica* and *B. hominis* were identified much more frequently at the Mbankomo District Hospital. All helminths in this study were identified at the Soa District Hospital (Table 3).

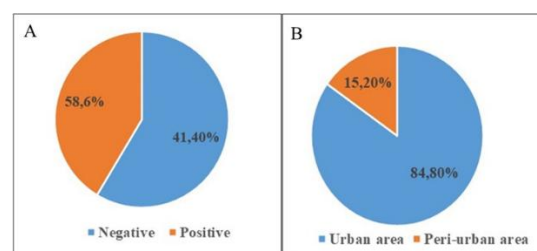


Figure 1: Intestinal parasitosis positivity: A. Global positivity, B. Positivity in urban area and in peri-urban area.

Table II: Intestinal parasites species identified in this study (N=173)

Intestinal parasites	N	%
Protozoa (n= 170)		
<i>Entamoeba histolytica</i>	68	39.3
<i>Entamoeba coli</i>	42	24.3
<i>Entamoeba hartmani</i>	3	1.7
<i>Blastocystis hominis</i>	42	24.3
<i>Endolimax nana</i>	4	2.3
<i>Giardia intestinalis</i>	6	3.52
<i>Iodamoeba butchii</i>	2	1.2
<i>Cryptosporidium</i>	2	1.2
<i>Trichomonas intestinalis</i>	1	0.6
Helminths (n= 3)		
<i>Ascaris lumbricoides</i>	2	1.2
<i>Strongyloides stercoralis</i>	1	0.6
<b>Total</b>	<b>173</b>	<b>100,0</b>

Tableau III : Intestinal parasites species identified according to recruitment hospitals

Intestinal parasites	YUHC	Biyem Assi Hospital	MBANKOMO Hospital	SAO Hospital	Total
<i>Entamoeba histolytica</i>	8	16	25	19	68
<i>Entamoeba coli</i>	8	11	14	9	42
<i>Entamoeba hartmani</i>	1	0	0	2	3
<i>Blastocystis hominis</i>	16	1	18	7	42
<i>Endolimax nana</i>	0	0	3	1	4



<i>Giardia intestinalis</i>	3	0	0	3	6
<i>Iodamoeba butchii</i>	1	0	1	0	2
<i>Cryptosporidium</i>	0	0	2	0	2
<i>Trichomonas intestinalis</i>	0	0	1	0	1
<i>Ascaris lumbricoides</i>	0	0	0	2	2
<i>Strongiloides stercoralis</i>	0	0	0	1	1
<b>Total</b>	<b>37</b>	<b>28</b>	<b>64</b>	<b>43</b>	<b>173</b>

### Risk Factors Associated with Intestinal Parasitic Infection

Table 4 shows highly variable positivity rates of intestinal parasitosis depending on the parameter considered. The highest rates were observed in female participants (46.0%), the 11–20-year age group being the most affected (66.0%). 39.7% of participants with symptoms tested positive, and 75.0% of HIV-positive participants tested positive. Logistic regression was used to identify risk factors associated with intestinal parasitic infection. A statistically significant association was found between sex and intestinal parasite positivity, with women being 1.7 times (OR; 1.055–2.867,  $p = 0.03$ ) more likely to be infected than men. Similarly, participants aged 16 to 25 years were observed to be 5.2 times (OR; 2.409–11.319,

$p < 0.0001$ ) more likely to develop an intestinal infection than those aged  $< 6$  years. Statistically significant association was observed between the type of water consumed and positivity; participants drinking tap water and Well water were respectively 2.7 times (OR; 1.386–5.096,  $p = 0.003$ ) and 3.2 times (OR; 1.886–5.551,  $p < 0.0001$ ) more likely to be infected than those drinking mineral water. Participants with average hygiene and those with poor hygiene were respectively 3.5 times (OR; 1.606–7.482,  $p = 0.002$ ) and 6.5 times (OR; 2.055–20.556,  $p = 0.001$ ) more likely to be infested than those with good hygiene. Risk factors such as anthelmintic use, HIV status, symptoms, and travel outside the area of residence showed no statistically significant association with parasitic infection positivity, as  $p$ -values were greater than 0.05.

**Table 4: Risk factors associated with intestinal parasitosis**

Variable	N	Parasitosis		COR <sup>1</sup>	P-value
		Negative	Positive		
Genus					
Male	101	68 (67,3)	33 (32,7)	1	
Female	201	109 (54,2)	92 (46,0)	1,739 (1,055-2,867)	<b>0,03</b>
Age group					
[0-10]	92	63 (68,5)	29 (31,9)	1	
[11-20]	50	17 (34,0)	33 (66,0)	2,016 (0,928-4,376)	0,076
[21-30]	60	29 (48,3)	31 (51,7)	5,222 (2,409-11,319)	<b>&lt;0,001</b>
[31-40]	51	38 (74,5)	13 (25,5)	1,332 (0,628-2,825)	0,455
[41-50]	10	6 (60,0)	4 (40,0)	1,060 (0,412-2,729)	0,904
> 50	39	24 (61,5)	15 (38,5)	1,583 (0,695-3,606)	0,273
Symptoms					
No	70	37 (52,9)	33 (47,1)	1,357 (0,793-2,324)	0,266
Yes	232	140 (60,3)	92 (39,7)	1	
Food source					
at home	264	149 (56,4)	115 (43,7)	2,161 (1,009-4,630)	<b>0,047</b>
outside home	38	28 (73,7)	10 (26,3)	1	
Travel outside the residence area					
Yes	46	26 (56,5)	20 (43,5)	1,106 (0,587-2,085)	0,755
No	256	151 (59,0)	105 (41,2)	1	
Type of drinking water					
Mineral water	138	100 (72,5)	38 (27,5)	1	
Tap water	54	27 (50,0)	27 (50,0)	2,658 (1,386-5,096)	<b>0,003</b>
Well water	102	46 (45,1)	56 (54,9)	3,236 (1,886-5,551)	<b>&lt;0,001</b>
Water in sachet	7	3 (42,9)	4 (57,1)	3,509 (0,758-16,576)	0,108
VIH statut					
Positive	12	9 (75,0)	3 (25,0)	1	
Negative	289	168 (57,9)	122(42,2)	2,179 (0,578-8,215)	0,25
Hygiene level					
Good	48	39 (81,3)	9 (19,1)	1	
Average	234	130 (55,6)	104 (44,4)	3,467 (1,606-7,482)	<b>0,002</b>
Poor	20	8 (40,0)	12 (60,0)	6,500 (2,055-20-556)	<b>0,001</b>
Regular use of anthelmintic medications					
Yes	63	42 (66,7)	21 (33,3)	1	
No	239	135 (56,5)	104 (43,7)	1,541 (0,860-2,760)	0,146

<sup>1</sup>Crude odds ratio

## DISCUSSION

Our study analyzed 302 stool samples, 228 of which were collected at Biyem-Assi District Hospital, 35 at the Yaoundé University Hospital Center (UTHY), 20 at Soa District Hospital, and 19 at Mbankomo District Hospital. A total of 263 samples came from the urban area and 39 from the peri-urban area of Yaoundé. This can be explained by the fact that urban populations have easier access to healthcare compared to peri-urban populations. As in a previous study, there were more women than men, likely due to the fact that in our context, women visit the hospital more frequently than men [14]. The most represented age group was 6-15 years ( $n=92$ ), followed by children under 6 ( $n=88$ ); the least represented age group was those over 45 ( $n=5$ ). Children are generally the most vulnerable to parasitic infections, especially those attending primary school, because they do not adhere to basic hygiene rules and, living in close quarters, share everything with their peers, thus facilitating the transmission of infectious germs. Children under six years old, in particular, are often careless and put everything in their mouths, increasing the risk of parasitic infection. This observation is confirmed by the high number of schoolchildren recruited for this study compared to university students and other professional categories. Overall, we obtained a positivity rate for intestinal parasitosis of 41.40%, with 84.8% in urban areas and 15.2% in peri-urban areas. This difference is likely due to the low participation rate of peri-urban populations in the study, probably resulting from limited access to healthcare facilities. A previous study conducted in three primary schools in the Maga town in the Far North region of Cameroon reported an overall prevalence of 30%, while another study conducted in the Dschang town found an overall prevalence of 14.68% [12-15]. We counted 173 parasites belonging to 11 species, of which 98.3% ( $n=170$ ) were protozoa and 1.7% ( $n=3$ ) were helminths. This result contradicts that reported by Soatoing's team in 2016, where helminths were more prevalent, particularly the genus *Schistosoma*, with a rate of 21.48% [12]. Species of the genus *Entamoeba* were more frequent than other protozoa (68% and 42%, respectively, for *E. histolytica* and *E. coli*). *E. histolytica* was also predominant in a study conducted in Ethiopia, with a rate of 33.3%, while *Giardia intestinalis* was more frequent (52%) in another study conducted in Yaoundé [7 – 11]. The reduced number of helminths ( $n=3$ ) would be attributed to the mass deworming campaigns organized by the Ministry of Public Health, primarily based on the distribution of anti-helminth drugs. The same observation was made in a previous study, which found intestinal parasitism mainly caused by protozoa, with a positivity rate of 52% for *Giardia intestinalis* and 15.3% for *Enterobius vermicularis* [11]. A greater diversity of parasite species was observed in the peri-urban area (7 species at Mbankomo District Hospital and 8 at Soa District Hospital), as well as the highest numbers of parasites ( $N=25$  and 19) in Mbankomo and Soa District

Hospitals, respectively. All three helminths identified in this study originated from Soa District Hospital, located in a peri-urban area. This finding reflects the precarious living conditions and lack of adherence to hygiene standards in the peri-urban area.

Multivariate analysis revealed an association between intestinal parasitosis positivity and certain socio-demographic and clinical characteristics of participants, with a  $p$ -value less than 0.05. These characteristics included sex ( $p = 0.03$ ), age group ( $p = 0.001$ ), feeding site ( $p = 0.047$ ), water type ( $p = 0.001$ ), and hygiene level ( $p = 0.001$ ). This demonstrates that parasitic infections are strongly influenced by both intrinsic factors (age, sex) and extrinsic factors (type of water consumed, hygiene level, etc.). A previous study showed that the quality of drinking water is one of the major factors contributing to the occurrence of intestinal parasitic infections [15]. Another previous study showed that the most exposed age groups were those aged 1 to 10 years and 11 to 20 years in Bamako between 2010 and 2015 [16].

**Contribution of the study:** This study updates data on intestinal parasitosis in Yaoundé and its surroundings, showing a real need to raise awareness among populations, especially those in the peri-urban area, about respecting hygiene rules and using latrines.

**Limitations of the study:** Very few people go to the hospital in peri-urban areas. For a more accurate assessment of the situation regarding intestinal parasitic infections, it would be beneficial to conduct a household survey to recruit a larger sample size.

## CONCLUSION

This study shows that intestinal parasitosis affects more than four out of ten patients attending Yaoundé hospitals, with higher prevalence in peri-urban areas (48.7%). Protozoa, especially *Entamoeba histolytica*, largely predominate. Modifiable risk factors include unsafe water consumption (tap, well) and poor hygiene. Three priority actions emerge: (1) improve safe water supply in peri-urban areas; (2) conduct hygiene and handwashing campaigns in schools and communities; (3) implement screening and treatment of asymptomatic carriers of *Entamoeba histolytica*. Intervention studies are needed to measure the impact of these measures on prevalence reduction.

## DECLARATIONS

### Contribution of the authors

"All authors contributed to the study conception and design, material preparation, data collection and analysis. The first draft of the manuscript was written by [Solange Meyin A Ebong, Sarah Pauline Ngo Miyem and Arlette Corine Modjo Fondjo] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript."

### Acknowledgements

We thank the health authorities of the city of Yaoundé, particularly the managers of the hospitals involved in our study (University Teaching Hospital Yaounde, Biyem-Assi District Hospital, the Soa District Hospital and the Mbankomo District Hospital) for the research

authorizations granted, as well as all the staff of these hospitals for their technical support and availability.

### Conflicts of interest

There are no financial or non-financial conflicts of interest between the authors.

### Ethics approval and consent to participate

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Centre Regional Ethics Committee for Human Health Research (CRERSH/C), with approval number CE N° 0247/CRERSH/2022 at 18 April 2022. Informed consent was obtained from all individual participants included in the study.

### REFERENCES

1. Laamrani A.I.E., Lyagoubi M., Barkia A., Ayouil V., Mahjour J. Prévalence des parasitoses intestinales au niveau de trois provinces au Maroc. *East. Mediter. H. J.*, 1999. 5 (1), 86-102.
2. OMS. Control of Schistosomiasis and soil transmitted helminthes infection; document A54/10. Communicable diseases, Report by the secretariat to the fifty-fourth world health assembly, Genève. 2001. Fifty-fourth World Health Assembly WHA54.19. [https://apps.who.int/gb/archive/pdf\\_files/WHA54/ea54r19.pdf](https://apps.who.int/gb/archive/pdf_files/WHA54/ea54r19.pdf). Consulted on January 2nd 2024.
3. Danis Martin, Faussart Alexandra, Paris Luc et Thellier Marc. Epidémiologie mondiale des maladies parasitaires. *La Revue du Praticien*. 2007. 57(2):131-136
4. Keita I. Sy. M., Traoré Doulo, Koné B. A., Bâ K., Wedadi Ould Boilil, Fayomi B., et al., Eau, hygiène, assainissement et santé dans les quartiers précaires à Nouakchott (Mauritanie): contribution à l'approche écosanté à Hay Saken. *Vertigo-la revue électronique en sciences de l'environnement*, (Hors-série 19) 2014 DOI:10.4000/VERTIGO.14999Corpus ID: 154791914
5. Afshar Mohammad Javad Abbaszadeh, Mehni Maryam Barkhori, Rezaeian Mostafa, Mohebalimehdi, Baigi Vali, Amiri Somayeh, et al.; Prevalence and associated risk factors of human intestinal parasitic infections: a population-based study in the southeast of Kerman province, southeastern Iran. *BMC Infectious Diseases*. 2020. 20:12 1-8 <https://doi.org/10.1186/s12879-019-4730-8>
6. Ohouya Dahi Ghislaine. Prévalence des parasitoses intestinales chez les enfants de 0 à 5 ans dans la communauté d'Anankoi 3. 2015. Thèse UFR Des Sciences Pharmaceutiques et Biologiques N°1735/15 p149.
7. Sunil Tulshiram Hajare, Robe Kuti Gobena, Nitin Mahendra Chauhan, and Feleke Eriso
8. Prevalence of intestinal parasite infections and their associated factors among food handlers working in selected catering establishments from Bule Hora, Ethiopia. *Hindawi BioMed Research International*. 2021. p15 <https://doi.org/10.1155/2021/6669742>.
9. Belhamri Nidal Profil épidémiologique des parasitoses intestinales au service de Parasitologie Mycologie à l'Hôpital Militaire Avicenne de Marrakech. 2014. Thèse, 1-115.
10. Bouratbine, A., Aoun, K., Siala, E., Chahed, M. K., Ben Hassine, L., & Meherzi, A. Pour une meilleure estimation de la prévalence du parasitisme intestinal dans la région de Tunis. *Bull Soc Pathol Exot*. 2000. 93(5), 353-355.
11. Bedziga Bedziga S., & Nguendo Yongsy H.B. Contribution à l'étude de la prévalence des parasitoses intestinales à Douala. *Médecine d'Afrique francophone*. 2023. 7005 279-290.
12. Enoka Patrice, Kamga Henri Lucien, Nizeyimana Jean Baptiste. Les parasitoses intestinales chez les enfants de zéro à cinq ans à Yaoundé-Cameroun. *Brainae Journal of Business, Sciences, and Technology*. 2022 9(2) : 1-9 ISSN 2789-3758.
13. Saotoing P., Djonyang, Dereng D.D. et Njan Nlôga A. M. Enquête épidémiologique sur les parasitoses urinaires et intestinales chez les élèves des écoles primaires de l'arrondissement de Maga, Extrême-Nord Cameroun. *International Journal of Biological and Chemical Sciences*. 2016. 10(1): 344-354, ISSN 1997-342X
14. ANOFEL Parasitologie et mycologie médicales Guide des analyses et des pratiques diagnostiques. Elsevier Masson SAS. 2022 1-40 ; ISBN : 978-2-294-77766-0
15. Zambou Vouking Marius, Enoka Patrice, Tamo Claire Violette, Nouboudem Tadenfok Carine. Prevalence of intestinal parasites among HIV patients at the Yaoundé Central Hospital, Cameroon. *Pan African Medical Journal*. 2014; 18(136): 1-5 doi:10.11604
16. Nguefeu Nkenfou Céline, Tafou Nana Christelle, Khan Payne Vincent. Intestinal Parasitic Infections in HIV Infected and Non-Infected Patients in a Low HIV Prevalence Region, West-Cameroon. *PLOS ONE*. 2013 8(2) : e57914. doi:10.1371/journal.pone.0057914
17. Yaro Alpha Seydou, Camara Fadima, Landouré Aly, Sodio Bernard Prévalences des Parasites Intestinaux Humains Chez les Patients du Service de Parasitologie de l'INRSP Bamako de 2010 à 2015. *European Scientific Journal*. 2019 ; 15(21) : e-ISSN 1857-7431.